

# Isolation and Pathogenicity Evaluation of Postharvest Fungal of Some Fruits in Cameroon

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**Abstract**— The present work was designed to study the biodiversity of fungal post-harvest decay of banana, mango and safou fruits sold in local markets in the Dschang locality, Western Region of Cameroon. A total of 90 infected fruit samples were collected from different local markets, small pieces of mouldy part were inoculated on prepared plates of Potato dextrose agar (PDA), after 7 days of incubation, pure isolated fungi were identified according to the recommended references. The pathogenicity of the some most prevalent fungi isolated was evaluated on uninfected fruits. Results obtained showed some variations in isolation frequency of the fungi from each fruit. Aspergillus, Colletotrichum, Fasarium and Veticillium were the most common genera that colonized banana, mango and safou fruits with different incidences. Cercospora capsici was present on safou (50%), C. mangiferae on mango (50.9%) and C. musae on banana (51.7%). Colletotrichum gloeosporioides appeared on banana (8.62%), mango (15%) and safou (22.92%); Colletotrichum musae on banana (22%). Cercospora spp caused injuries with lesions diameters that vary depending on the type of fruit and fungal species. Proper measures should be adopted to protect fruits from fungal decay.

**Keywords**—Fruits, Post-harvest fungi, Isolation, Pathogenicity, Western Region, Cameroon.

## I. INTRODUCTION

Fruits play an important role in human nutrition by contributing the necessary growth factors such as vitamins and essential minerals in human daily diet maintaining a good and normal health. It has been recognized that fruits are commercially and nutritionally important food product. Rot diseases caused by fungal pathogens provoke severe losses of agricultural and horticultural crops every year (Salman, 2005; Parveen *et al.*, 2016). Fruits have wide distribution in nature. Tropical fruit production knows more and more increased with fresh bananas which was ranked 1st, with more than 145 million tons produced in 2011 globally (FAO, 2011). Cameroon's production of sweet banana in 2010 was 1 333 851 tons. The mango and the safou, despite their low production, also feature prominently after the banana. The

relatively short shelf-life period provoked by pathogens is one of the most important limiting factors that impact the economic value of fruits. Approximately 20-25% of the harvested fruits are deteriorated by pathogens during post-harvest handling even in advanced countries (Droby, 2006). The postharvest losses are often more harsh in developing countries due to lack of storage and transportation facilities. Fruit infections by fungi may appear during the growth period, harvesting, handling, transportation and post-harvest stockpile and marketing conditions, or after procuring by the consumer. Fruits incorporate high levels of nutrients element and sugars and their low pH values make them exceptionally desirable to fungal decay (Singh *et al.*, 2007). Fungi are considered as an essential post-harvest losses agent of different fruits, based on cultivar, season and production area amid other factors (Valiuskaite *et al.*, 2006; Ewekeye *et al.*, 2016). Fungi are the most crucial and common pathogens and the main cause of crop diseases. It Infect a wide range of fruits and vegetables during storage and transportation (Sommer, 1985).

The importance of post-harvest diseases is now recognized by fruits producers since serious losses occurred during the transit. In Cameroon, banana and mango are almost produced all over the country (MINADER, 2012). Fruits play an important role in socioeconomic. Surveys conducted by Hartill and Everett (2002), Everett *et al.* (2007) showed that anthracnose, stem rot, galls, fruit spot and fruit rot were the most important fungal diseases. The incidence of these diseases can be up to 90% in areas with high relative humidity (COLEACP, 2008). Little information is available on the fungi associated with some fruits in Cameroon. This study was aimed at isolating and identifying the fungi associated with post-harvest decay of bananas, mangoes and safou from different localities in the Dschang market, Cameroun.

## II. MATERIALS AND METHODS

### Collection of samples :

Ninety samples of infected and uninfected fruits were randomly collected from some markets in the city of Dschang in May 2016. Thirty samples of each the fruits

banana, mangos and Safou were collected. Samples were separately kept in clean plastic bags, transferred to the Phytopathology laboratory of the University of Dschang and stored in a refrigerator for mycological analysis.

#### **Isolation and identification of fungi :**

The direct plating technique described by Pitt and Hocking (1985) was employed. The fruit samples were surface sterilized for 3 minutes with 1% NaOCl and rinsed in four successive changes of sterile distilled water. Four small pieces from the margin of lesion of each sample were directly inoculated on prepared plates of Potato dextrose agar which contain (g/L): peeled potato 100.0g, glucose 20.0g, agar 15.0g, water 1000.0 ml. The medium was supplemented with chloramphenicol (250 mg per liter) as a bacteriostatic agent (Smith and Dawson, 1944). The plates were inoculated at  $28 \pm 1$  °C for 5 to 7 days. Three replicates were prepared for each sample. The resulting fungi were isolated, purified and identified according to their macro and micro characteristics.

#### **Identification of fungal genera and species :**

The pure isolated fungi were identified following the most documented keys in fungal identification (Raper and Fennell, 1965; Barnett and Hunter, 1972; Pitt, 1985, Moubasher, 1993; Alexopoulos and Mims, 1996; Klich, 2002; Agrios, 2005).

#### **Pathogenicity test :**

The pathogenicity test was done on apparently healthy mature fruits. The method of inoculation by wound of fruits was used Rivera-Vargas *et al.* (2006). The inoculated fruits were kept in laboratory conditions ( $22 \pm 2$  °C) for seven days. Data collected on the lesions developed by the fungus. For this test, the 3 species of *Cercospora* genus isolated from fruits were used, namely *C. capsici*, *C. mangiferae* and *C. musae*.

#### **Statistical analysis :**

Frequency occurrence of isolation of each fungus and diameters of lesions developed on fruits were calculated. Data obtained was analyzed statistically using SPSS (Version 17).

### **III. RESULTS AND DISCUSSION**

The biodiversity of fungal species listed on Table 1 could be regarded as common post-harvest decay agents of various studied fruits. Through this investigation at  $28 \pm 2$  °C nine fungal species attributed to six genera were isolated. *Aspergillus*, *Cercospora*, *Colletotrichum*, *Fusarium* and *Verticillium* were the most common genera that colonized banana, mango and safou fruits with different incidences (Fig. 1). In which *Aspergillus* was represented by *A. niger*, *Cercospora* (3 species), *Fusarium* and *Verticillium* by one spece. *Cercospora* contained 3 species namely *C. capsici*, *C. mangiferae* and *C. musae*. *Fusarium* and *Verticillium* genera were

represented by one specie for each namely *F. oxysporum* and *Verticillium albo-atrum*. *Cercospora* was by far the most common genus affecting the different kinds of fruits. It appeared on 50 % each of banana, mango and safou fruits (Fig. 1). *Aspergillus*, *Colletotrichum*, *Fusarium* and *Verticillium* were the second most common genus affecting these fruits. *A. niger* was found on banana (8.62%), and mango (15%) and safou (12%). *Colletotrichum gloeosporioides* appeared with variable incidences on banana (8.62%), mango (15%) and safou (22.92%). Other species showed higher affinity towards certain fruits such as *Rhizoctonia solani* on mango and safou fruits.

#### **Pathogenicity of fungal species:**

Table 2 shows the diameters of lesions caused by the 3 species of *Cercospora* genus on the fruits of banana, mango and safou. Different species of *Cercospora* caused injuries with lesions diameters that vary depending on the type of fruit and fungal species. It should be noted that all the types of fruits used presented lesions.

Developed lesions varied from 22 mm to 36 mm on banana fruit, from 19 mm to 45 on mango fruit and from 16 mm to 24 mm on safou fruit. *C. mangiferae* and *C. capsici* caused injury significantly greater than that caused by *C. musae* on bananas. On mango fruit, *C. mangiferae* and *C. musae* caused injuries to 45 and 36.5 mm respectively while that caused by *C. capsici* was 19 mm.

It should be noted that damage caused by fungi on the safou fruits were weak compared to those caused on the banana and mango. However the safou fruits showed more likely *C. capsici* with a lesion of 24 mm. *C. mangiferae* confirmed its pathogenicity to the mango fruits. Figure 2 presents some of the lesions caused by species of genus *Cercospora* on the fruits.

This investigation embraces an extensive survey of the fungi associated with post-harvest rot of fruits in samples collected from markets in Dschang. The tested samples comprised of banana, mango and safou fruits. In this respect, Akinmusire (2011) and Chukwuka *et al.* (2010) mentioned that fruits can be affected by a wide range of microorganisms such as fungi which have a serious threat to production of fruits. Spoilage attributed to any change in the condition of food makes it less palatable, or even toxic; these alterations may be accompanied by changes in taste, smell, appearance.

During the first part of this investigation, it was possible to isolate 9 species belonging to 6 fungal genera from the samples of fruits. Some of these fungi are reported by several authors to be commonly implicated in the postharvest deterioration of many fruits and vegetables in the Tropics (Hartil and Evertt, 2002; Everett *et al.*, 2005; Regnier *et al.*, 2010; Onyeani *et al.*, 2012; Didy *et al.*, (2013); Amadi *et al.*, 2014 ; Djeugap *et al.*, 2015)

During this study, *Colletotrichum musae* was also isolated and it is known as the causative agent of banana rot. Scott, (2001) found that the two primary post-harvest rots of banana fruits in Hawai'i were crown rot and anthracnose caused by the fungus *C. musae*. Raut and Ranade (2004) and Ranasinghe *et al.* (2005) reported that, banana suffer from serious post-harvest losses caused by fungal infections, especially *C. musae*.

*Colletotrichum* spp have been reported to affect fruits, causing disease on immature and growing fruits in the field conditions, and damage fruits during transportation and storage (Wharton *et al.*, 2004).

Species such as *Cercospora musae* or *Mycophaerella musae*, *Cercospora mangiferae* and *Cercospora capsici* were the most frequent compared with other fungal species isolated. These three species are generally reported to cause significant damage to fruits.

*A. niger*, *R. solani*, *F. oxysporum* and *F. solani* were relatively less important on these in respect to their low isolation frequencies. These fungi however have been reported as pathogenic in some fruits including mango, apple, banana and grape in other part in the tropics (Kortsen *et al.*, 1994; Bashar *et al.*, 2012). Several reports showed the implication of *A. niger* in spoilage of many fruits and vegetables (Bali *et al.*, 2008; Tafinta *et al.*, 2013). The origin of fruit contamination by fungi is difficult to determine. Generally, contamination of agricultural product is a function of many factors including infestation in the field prior to harvest, handling during harvesting and methods of packaging and transportation of the product to the market (Amadi *et al.*, 2014).

#### IV. CONCLUSION

Several fungal species belonging to 6 fungal genera could be regarded as the most common causes of post-harvest deterioration of banana, mango and safou fruits in the Dschang markets, Western region of Cameroon. Results suggested the need of developing appropriate management strategy to control post-harvest diseases caused by *Cercospora* spp, especially since their pathogenicity has been proven on these fruits.

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Fig.1: Lesions caused by *Cercospora* spp on banana and safou fruits

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Table.1: Different types of fungal species isolated from deteriorated fruit samples during this investigation.

Genus	Species	Banana	Mango	Safou
Aspergillus	<i>A. niger</i>	+	+	+
Cercospora	<i>C. capsici</i>	-	-	+
	<i>C. mangiferae</i>	-	+	-
	<i>C. musae</i>	+	-	-
Colletotrichum	<i>C. gloesosporioides</i>	+	+	+
	<i>C. musae</i>	+	-	-
Fusarium	<i>F. oxysporum</i>	+	+	+
Rhizoctonia	<i>R. solani</i>	-	+	+
Verticillium	<i>V. albo-atrum</i>	+	+	+
No. of species		6	6	6

+ = Present; - = absent

Table.2: Diameters (mm) of the lesions developed on fruits by Cercospora genus

Fruit	Diameters (mm) of the lesions			Witness
	<i>C. musae</i>	<i>C. mangiferae</i>	<i>C. capsici</i>	
Banana	22.12 ± 4.82 <sup>b</sup>	36.00 ± 5.84 <sup>a</sup>	31.75 ± 2.33 <sup>a</sup>	0
Mango	36.50 ± 7.58 <sup>a</sup>	45.00 ± 11.22 <sup>a</sup>	19.88 ± 3.42 <sup>b</sup>	0
Safou	16.12 ± 6.70 <sup>b</sup>	16.37 ± 4.46 <sup>b</sup>	24.31 ± 5.50 <sup>b</sup>	0

Values followed by the same alphabetical letter in the same column are not significantly different according to Duncan test.

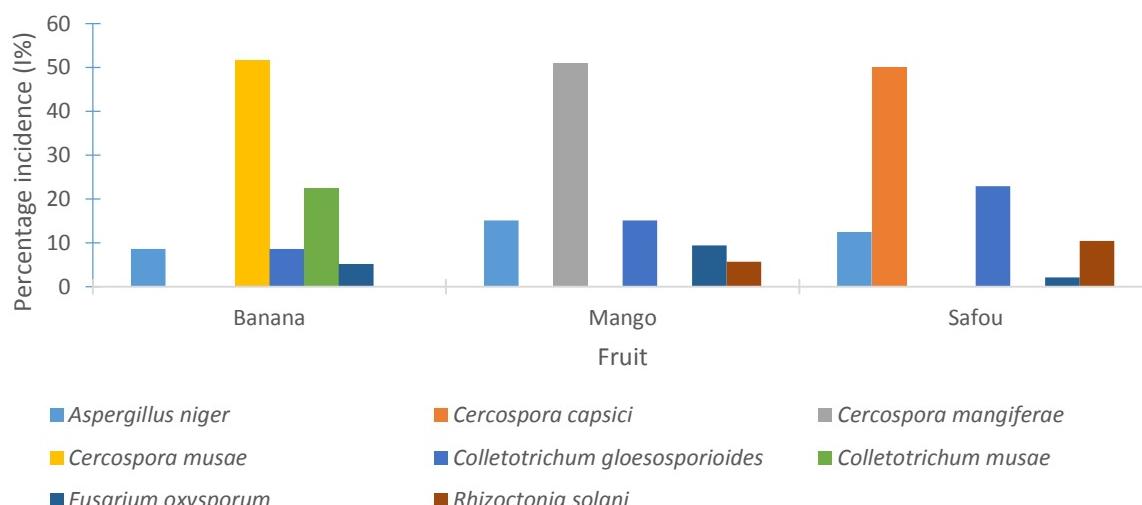


Fig.2 : Prevalence of the most common fungal species isolated from different fruits